LETTERS TO THE EDITOR.

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British Mosses.

In the review of Dr. Braithwaite's "British Mosses" which appeared in your number of August 31 (vol. lxxii. p. 425), I attributed the finding of *Catharinea tenella* to Lord Justice Stirling, and I did so on the authority of a passage relative to the plant in Dr. Braithwaite's supplement. The Lord Justice is, I find, desirous that it should be known that the entire merit of the discovery is due to Mr. E. S. Salmon. "I had the good fortune," says the learned judge, "to be his companion when the little plants were gathered, but his eye detected them in the field, and by his acuteness the true name of them was discovered." I am glad to second the Lord Justice in his desire that no mistake should be made in this matter, and I beg your courtesy to insert this short note.
E. F.

November 8.

Border occasionally seen between Light and Dark Regions on Photographic Prints.

Since my recent brief note on a photographic appearance, Mr. Burke has informed me that the subject attracted the attention of Sir George Stokes, and was thought worthy of a communication from him to the Royal Society in May, 1882 (*Proc. Roy. Soc.*, vol. xxxiv. p. 63).

Had I been aware of that I should, of course, have referred to it. It seems to me now that there may be more than one explanation of such an appearance.

Oliver Lodge.

Halation.

When a photograph is taken of a dark object with a bright object or the sky some distance behind it, blurring occurs where the images of the objects meet.

That part of the bright object from which only a part of the lens is visible (the rest of the lens being cut off by the dark object) forms an image of varying brightness in the shape of a band which covers the edge between the images of the dark and light objects. If the bright object be at an infinite distance from the lens, the breadth of the band will bear approximately the same ratio to the diameter of the lens as that which the focal length of the lens bears to the distance of the lens from the near object.

It seems probable that many cases of halation are due to this cause.
J. A. Cobb.

108 Church Road, Richmond, Surrey, November 13.

The Engineer's Unit of Force.

I am much indebted to "The Reviewer" for his courteous answer to my letter on the subject of the engineer's unit of force in your issue of November 2.

I readily admit that the engineer's unit of force may be so defined as to make it a constant quantity independent of locality; but does the engineer *in actual work-a-day practice* make use of this invariable unit? In problems involving the derived unit of work, does he not, as a matter of fact, estimate the work done or the potential energy, as the case may be, by multiplying together the distance factor and the weight (*i.e.* the force) factor *without making any allowance for the variation of the latter with latitude?*

The question at issue, it seems to me, narrows itself down to this:—is the title "engineer's unit of force" to be applied to the variable unit in actual use by the engineer, or is it to be restricted to the absolute gravitational unit, which may be defined, but which in nine cases out of ten is not actually applied in engineering practice?
D. J. Carnegie.

Newton Abbot, November 6.

It is quite true that in engineering practice a correction for latitude is seldom made in regard to the gravitational energy of a raised weight, the reason being that other and very much larger sources of error are usually present. But under sufficiently refined conditions this small correction is actually made. A Bourdon pressure gauge registers pounds per square inch in absolute measure the same everywhere. If Mr. Carnegie considers the pound force to vary with locality, what is his value, in foot pounds, for Joule's equivalent at the centre of the earth?

But surely even Mr. Carnegie himself must use the foot-pound unit, and hence the pound-force unit, in an absolute sense, when applied to such quantities as the kinetic energy of a rotating fly-wheel, the strain energy of a stretched spring, the work done on the piston of a steam or gas engine, the energy of motion or of position of a planetary body, &c.

The present case is an illustration of the apparent inability of academic writers to understand the engineer's position in this matter, and of the confusion which inevitably arises from the combination of two closely related systems of units. In any dynamical system the magnitude of unit mass is quite arbitrary, and the pound mass possesses no intrinsic merits over any other unit. Indeed, the choice of the pound unit has proved to be a most unfortunate one, for the conception of inertia or mass, coming as it does after that of force, finds the pound force already established and ingrained in the mind, forming an effective barrier against the practical adoption of the derived poundal, and being a fruitful source of error on account of the new and old meanings attached to the word pound. People do not, and never will, think in poundals, and so custom has compelled its advocates to incorporate into their system the pound force and the foot-pound unit of work, a tacit admission of its practical failure. Engineers contend that this duplex system with its overlapping terms is harmful and quite unnecessary. They advocate a single system which, so far as possible, shall adopt units in common use. The system used by them fulfils all requirements. It is an absolute dynamical system. Its terminology is not divorced from common thought and speech. It gives an exact and absolute meaning to the pound force and consequently to the foot-pound unit of work, and its unit of inertia has a distinct name of its own, never used in the sense of force, thus avoiding the conflicting nomenclature of the present mixed system. The engineer's and the C.G.S. systems are sufficient for all purposes, and it would be a great gain if the academic British system could be abandoned.
The Reviewer.

THE EXPLORATION OF THE ATMOSPHERE OVER THE TROPICAL OCEANS.

The study of the trade-wind region by the use of kites was first proposed by Mr. A. L. Rotch at the meeting of the British Association at Glasgow in 1901, after he and his assistant, Mr. Sweetland, had obtained a series of observations with them during a voyage across the North Atlantic. This method of investigation was later adopted by other meteorologists, notably by the French Scandinavian expedition to explore the atmosphere, which, under the direction of M. L. Teisserenc de Bort, flew kites in 1902 on the Baltic, and last year by Prof. Hergesell, who communicated to the Aëronautical Conference at St. Petersburg the interesting results of a cruise on the yacht of H.S.H. the Prince of Monaco in the vicinity of the Azores and Canaries. During this voyage fourteen kite-flights, some of which reached a great height, were made, and in a communication to the French Academy of Sciences on January 30 Prof. Hergesell said:—"Un courant de S.W., qui correspondrait au contre-alizé théorique, n'a jamais été trouvé par les cerfs-volants bien qu'ils aient plusieurs fois dépassé la hauteur du Pic de Ténériffe. Plusieurs constatations m'amènent à penser que les vents de S.W. observés au Pic par plusieurs observateurs sont d'origine locale et dûs à l'influence de l'île."

Thus Prof. Hergesell believes that the north-west wind which was found overlying the thin north-east stratum is a return current, or anti-trade, for he says:—"Der Luftersatz im Anti-passat erfolgte deshalb vorwiegend in der von uns durchforschten Gegend aus nordwestlichen Richtungen" (Aëronautical Conference, St. Petersburg, 1904, supplement vii., p. 91).

It appeared to the writers that these conclusions, which tended to invalidate the existence of the upper anti-trade, required further investigations, and by mutual consent we decided to have these carried on by two of our assistants, Mr. Clayton, meteorologist at Blue Hill, and M. Maurice, assistant at Trappes, aboard the *Otaria,* a large fish-carrying steamer, equipped with the electric kite-reel which M. Teisserenc de Bort had used for kite-flying at sea.

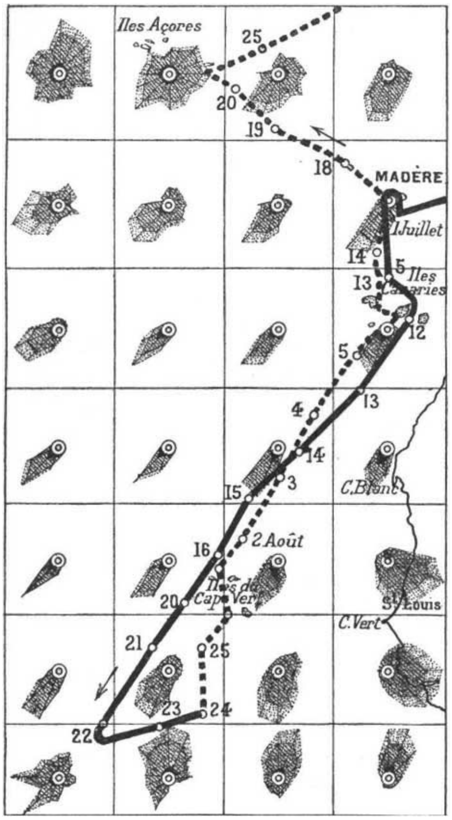

FIG. 1.—The route of the *Otaria.* The diagrams in centrei of squares show the mean direction of surface winds in summer, ty Captain L. Brault.

A study of the high barometric pressures at the Observatory of Trappes (see *Comptes rendus,* 1899) led to the conclusion that there exists, generally, at a moderate altitude, a zone of light winds which ordinarily the kites cannot penetrate. While it is true that at sea an artificial breeze may be created by steaming in a direction contrary to that of the wind, this method is inefficient in the trades, because, if, as is usually assumed, there is almost complete reversal in the directions of the upper and lower winds, the top kite arrives in the south-west current while the others are still in the north-east wind, and consequently the flight is stopped just where the change of regime commences. Therefore it is necessary to employ a single kite and a boat which is sufficiently fast to lift the kite regardless of the direction of the wind, but as these conditions cannot always be realised, in order to attain great heights on this expedition the paper pilot-balloons already tried at Trappes were used. Since these balloons were only intended to show the direction of the wind, they did not usually carry instruments, and their drift and height were determined by simultaneous angular measurements at the ends of a base-line on the shore, with the exception of one balloon which was observed from the boat. These soundings of the atmosphere, executed at various places, notably at Madeira, Teneriffe and Cape Verde Islands, and also over the open sea, gave the following results, to which are added observations of winds on two tropical mountains and during one of the kite-flights.

In the table on p. 56 the first column indicates the upper limit of the north-east trade, and the second column the limit of the associated north-west wind, these heights being expressed in metres. In the third column the figures in parenthesis show the maximum heights at which the balloons were observed moving in the anti-trade, from south-east, south, or south-west.

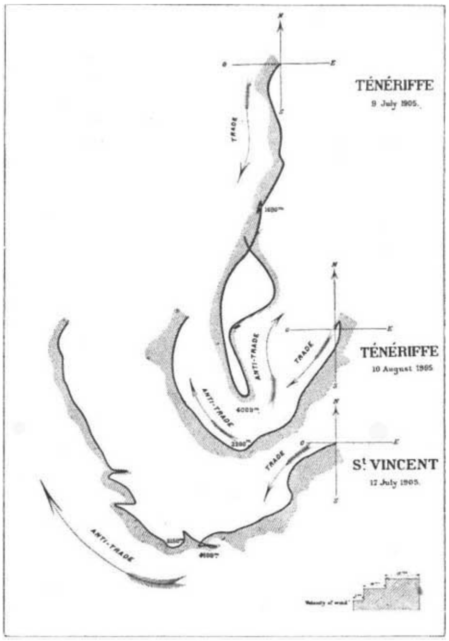

FIG. 2.—Direction of wind at great height, shown by the tracks of balloons.

There follow observations at different heights on the peaks of Teneriffe and Fogo, the figures after the direction of the wind being its velocity in metres per second. There is also noted the drift of the clouds passing above the peaks. The diagrams (Fig. 2) represent the direction and speed of the balloons which were sent up from Teneriffe on July 9 and from St. Vincent on July 17.

The tables and figures show that the winds blowing toward the equator have a direction varying between N.E. and N.W., these last being usually above the N.E. stratum, the thickness of this layer of the *trades* in the vicinity of Teneriffe being about 3000 metres or 5000 metres. Above it blow S.E., S., and S.W. currents which form the *anti-trades,* its thickness being probably very great, though its density is small. Thus, as was deduced from the observations of clouds and volcanic dust, the east wind in the vicinity of the thermal equator extends very high. At the Cape Verde Islands the south-east wind was observed by a balloon up to a height of 11 kilometres.

As is seen, these results confirm the accepted theory of the *trades* and upper *anti-trade* in those parts of the Atlantic explored by the *Otaria* (see chart of route, Fig. 1), and prove that, contrary to the opinion of Prof. Hergesell, there exists a return current, or anti-trade, with a well defined southerly component.

We hope to give in a subsequent article the conclusions regarding temperature and humidity derived from the kite-flights made on the *Otaria*.

Winds above the Atlantic, between latitudes 11° *and* 37° *N., longitudes* 15° *and* 26° *W., observed during the cruise of the S.Y. "Otaria" in* 1905.

Punta Delgada—
August 22 ... ... 800 N.E. ... (4200) N.E.
Madeira—
Aug. 16, 1800 W.N.W.; 11,500 N.W. & S.W.[1]; (11,600) W.S.W.
,, 17, 2900 N.E.; 4,200 N.W. & N.E.; (12,500) W.S.W.

	Trade		Anti-Trade
Teneriffe—	N.E.	N.W.	S.E., S., S.W.
	metres	metres	metres
July 7	400	3500	(7500)
,, 9	300	4000	(5760)
,, 10	3000	5200	(11,000)
Aug. 10	3100	none	(5900)
,, 11	2300	,,	(3900)
At sea near Palma—			
Aug. 13	2600	3400	(6500)
St. Vincent—			
July 17	3200	3700	(11,000)
,, 18	1300	none	(2360)
,, 29	650	1900	(11,000)
11° N., 26° W. (Kites)—			
July 24	2500	(3000) E. ? strong	

Peak of Teneriffe—
Aug. 8 ... Base, E. 2; 500, E. 0; 1000, calm; 1500, N. 2; 2000, N. 2; 2500, N.N.W. 4; 3000, wind variable; 3500, S.; 4000?, Al.-Cu. clouds moving from S.
Peak of Fogo—
July 27–28. Base, wind variable; 500, E. 1; 1000, N.E. 13; 1500, N. 9; 2000, N. 7; 2500, E.N.E. 7; 3500?, Al.-Cu. from E.

A. L. ROTCH.
L. TEISSERENC DE BORT.

SOUTH AFRICAN ZOOLOGY AND PALÆONTOLOGY.

THE recent visit of the British Association to South Africa affords a favourable opportunity of directing attention to the zoological and palæontological work now being carried on by the museum at Cape Town under the able direction of Mr. W. L. Sclater, more especially as exemplified in that excellent serial publication entitled the "Annals of the South African Museum." Of this serial, which commenced in 1898, three volumes have been completed, and some seven parts of the fourth volume published up to the end of July of the current year, making a total of at least twenty-nine separate parts, each devoted to a special subject.

From the time that he took charge of the museum, Mr. Sclater appears, indeed, to have determined to devote all his energies towards increasing our knowledge of the fauna of South Africa. His mode of accomplishing this praiseworthy object seems to be threefold. In the first place, efforts have been made to increase the collections in the museum at Cape Town—both as regards the exhibition and the study series—by all possible means, and thus to afford as ample a basis as possible for the work of specialists, and at the same time to awaken increased interest on the part of the public in the museum itself. The second part of the programme consists in the publication of monographs of such portions of the South African fauna as are ripe for this mode of treatment. As examples of work of this nature may be cited the handsome volumes on the mammals and birds of the country, published some few years since, and duly noticed in our columns as they appeared.

Work of the above nature consists to a great extent in collating, revising, and adding to the labours of earlier naturalists; but, in addition to this, much of an altogether newer type has to be made known to the scientific world in such a rich, and in many respects little-worked, field as that presented by South Africa. And it is to work of this latter description that the "Annals of the South African Museum" are mainly devoted. Fortunately, the officers of the Geological Survey of Cape Colony have availed themselves of this excellent means of publishing the results of researches into the palæontology (both zoological and botanical) of this part of South Africa, and the "Annals" accordingly promise to afford within a few years a perfect mine of information with regard to South African zoology and palæontology.

Although the description of more or less entirely new work occupies much of the "Annals," monographs of groups, or revised lists of groups already monographed, come within its purview. For example, the moths of South Africa, which for many reasons could not probably be monographed in separate volumes, are in course of description by Sir George Hampson, of the British Museum, and two parts of his monograph have already appeared. Again, Mr. Sclater has taken advantage of this mode of publication to issue a revised list of South African birds, containing such additions and corrections as have been made since the issue of the volumes on this group in the series devoted to separate monographs of the South African fauna.

To mention by name all the papers included in the volumes of the "Annals" already published would be altogether beyond the limits of available space, and it must suffice, therefore, to refer to a few others. In the palæontological series, the first part of the important account of the fossil floras of the Cape, by Mr. A. C. Seward, of Cambridge, has already received special notice in NATURE. The molluscs and brachiopods of the Bokkeveld beds respectively form the subjects of two papers by Mr. F. R. C. Reed; and these and the trilobites, which are described in another paper by Mr. P. Lake, serve to demonstrate the Devonian age of the beds in question, and thus point to a definite period when at least a part of what is now South Africa was beneath the sea. The affinity of the trilobites to South American types is noteworthy. A fifth paper, by Mr. F. Chapman, is devoted to the foraminifera and ostracods from shallow water deposits of Lower Cretaceous age in East Pondoland. In the zoological series, in addition to those already mentioned, six papers by Mr. Peringuey, assistant director of the museum, form an important contribution to our knowledge of South African beetles; while in another part the Rev. O. Pickard-Cambridge has described a number of new spiders, including three new generic types; and there are many other papers of equal importance and interest.

In conclusion, we congratulate all those who have done so much good which this serial has been the means of communicating to the world, and trust that financial considerations will not be allowed to interfere with the continuation of such a valuable and important publication.

R. L.

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[1] Mixed stratum of N.W. and S.W. winds.